A REVIEW OF THE INDO-PACIFIC GIZZARD SHAD GENERA *NEMATALOSA*, *CLUPANODON* AND *KONOSIRUS* (PISCES : DOROSOMATIDAE)

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A REVIEW OF THE INDO-PACIFIC GIZZARD SHAD GENERA *NEMATALOSA*, *CLUPANODON* AND *KONOSIRUS* (PISCES : DOROSOMATIDAE)

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ABSTRACT

The three genera of Indo-Pacific Dorosomatidae with filamentous last dorsal rays have been examined. Although closely related, *Clupanodon* and *Konosirus* are here separated from *Nematalosa* and from each other on a number of characters, including the shape of the suboperculum and jaw form. There seems to be little justification for placing the Australian species in the genus *Fluvialosa*, and all are here referred to *Nematalosa*. *N. arabica* is redescribed from specimens now in the Museum collection.

1. INTRODUCTION

While identifying specimens of *Nematalosa arabica* Regan from the Somalia coast and the Gulf of Aden, I noticed that no further description of this species has been made since Regan's (1917) description of the holotype. But in redescribing *N. arabica*, it was necessary to make comparisons not only with other species of *Nematalosa*, but also with the monotypic genera *Clupanodon* and *Konosirus*, the last in some respects an annectant form between the other two. The result of this comparison has been to reinforce the view of Herre & Myers (1931) that *K. punctatus* (Schlegel) is generically distinct from *Clupanodon thrissa* (Linn.), but that it should not be relegated to *Nematalosa*. The latter genus shows some variation, especially in lower jaw shape, but there are too many intergrading forms for any but specific divisions to be considered.

2. *NEMATALOSA* AND ITS ALLIES IN THE INDO-PACIFIC

Seven species are included under this heading (eight if *Nematalosa elongata* (Macleay) is accepted). All have an elongated last dorsal ray and a single supplemental or supra-maxilla. Although the importance of an elongated dorsal ray is perhaps over-rated, I have here omitted consideration of the two Indo-Pacific dorosomatid genera lacking a filamentous ray, *Gonialosa* and *Anodontostoma*. Regan (1917) proposed *Nematalosa* for those species (until then included in *Chatoessus* Cuvier), which in addition to possessing a dorsal filament and single supra-maxilla, also had a flared or reflected edge to the dentary ; two related forms without flared dentaries he placed in *Clupanodon* Lacépède (*C. thrissa* (Osbeck) and *C. punctatus* (Schlegel)), putting *Konosirus* Jordan & Snyder in the synonymy of *Clupanodon*.

However, Herre & Myers (1931) stated that the dentary in *C. punctatus* is to some extent reflected as in *Nematalosa*, but that *C. punctatus* differs sufficiently in other respects from *Nematalosa*, as well as from *Clupanodon*, to justify a monotypic genus, *Nealosa* (suppressed (Myers, 1932) since *Konosirus* had already been applied to *punctatus*). *Konosirus* has frequently been placed in the synonymy of *Clupanodon* (e.g. Fowler, 1941, Roxas, 1934) or again considered of subgeneric standing only, but some authors have recognized it (Iwai, 1956).

After examining material in this museum, I conclude that the criteria used by Herre & Myers to separate *Konosirus* are valid and should be re-emphasized. To them can be added also the rather higher vertebral count in *K. punctatus*, e.g. :

K. punctatus . .	48, 50, 51
C. thrissa . .	43
N. arabica . .	46
N. erebi . .	43*

(Also *Anodontostoma* 42 ;* *Gonialosa* 44,* 46.*

Clupanodon thrissa is unique in this group in having the outer demibranchs of the first two arches very short, about half the length of the corresponding inner demibranchs, and this character, together with its normal [non-flared] dentary and its subopercular shape (see below), clearly distinguish it from *Nematalosa*. But if such differences merit generic distinction, then the high vertebral count in *Konosirus punctatus* as well as its flared dentary and normal demibranchs must be sufficient reason to separate it generically from *Clupanodon*, while its subopercular shape and proportions of maxilla and premaxilla must distinguish it from *Nematalosa*. The characters on which this argument is based are discussed separately below.

Of the species normally placed in *Nematalosa*, four require little comment. *N. arabica* Regan and *N. japonica* Regan occupy the western and eastern limits of the range of this genus (i.e. Red Sea to Japan), *N. nasus* (Bloch) occurs in the central part of this region (India and Burma) and *N. come* (Richardson) is a Western Australian species. The remaining species, all Australian, have been placed in *Fluvialosa*, a genus proposed by Whitley (1943) for *Chatoessus elongatus* Macleay, *N. horni* (Zeitz) and *N. richardsoni* (Castelnau), and later (Whitley, 1948) for *F. paracome* Whitley

* Figures from Regan (1917).

and *F. bulleri* Whitley, and again (Whitley, 1956) for *N. erebi* (Günther). These species can all be adequately accommodated in Regan's *Nematalosa*, but they were distinguished by Whitley as being " large fluviatile or estuarine Australian herrings " as opposed to the genotype of *Nematalosa* " the marine *Clupea nasus* Bloch " (Whitley, 1943).

As will become apparent in later discussion, *N. horni* and *N. erebi* are rather distinctive in comparison with other species of *Nematalosa*, especially in their greater body depth, few ventral scutes and jaw shape. On the other hand the species which most nearly approaches these Australian forms is none other than the " marine " *N. nasus*. Certainly the Australian forms cannot be separated from the rest with the same confidence as in the case of *Konosirus* or *Clupanodon*. I consider it reasonable, therefore, to place *Fluvialosa* in the synonymy of *Nematalosa*.

Whereas *N. horni* and *N. erebi* appear to be valid species, *N. richardsoni* is problematical. It was originally described as a smaller fish than *N. erebi*, with an average length of 7 inches (Castelnau, 1873), but Macleay (1880) refers to it as attaining 10–14 inches. Unfortunately the descriptions of both these authors are too vague to distinguish this species from *N. erebi*, and its distinctive features (dorsal filament short, body more slender) may be juvenile characters or characters whose growth shows positive allometry with standard length. Fowler (1941) places *N. richardsoni* in synonymy with *N. come*, together with *N. erebi* and *N. horni*, but this seems unjustifiable " lumping " since the latter two at least, differ from *N. come* in numbers of scutes and dorsal rays and mouth shape. I have not seen specimens of *N. elongata*, but descriptions suggest a species very close to, if not identical with *N. horni*.

The two remaining species, *N. paracome* and *N. bulleri* are also unrepresented in the museum collections. The former, described from a single specimen, is said to differ from other species in having no humeral blotch (although a " faint duskiness " is described) ; a shorter dorsal filament (although as a percentage of standard length it differs by only 1·7 per cent. from that of *N. bulleri* according to actual measurements given by Whitley, 1948) ; and fewer predorsal and lateral scales (respectively two and four fewer than in *N. bulleri*).

The Australian species have not been described sufficiently critically for comparisons to be made on the basis of descriptions alone. All however, have rather fewer scale and scute counts than do the other Indo-Pacific species, and (except for *N. elongata*) all are rather deep-bodied fishes. It seems probable that all have the flared dentary and rather inferior mouth characteristic of *N. erebi* and *N. horni*. But although these Australian fishes form a fairly distinctive group, they are none the less linked by *N. come* and *N. nasus* to the remaining Indo-Pacific species ; there is no definite point at which the genus *Fluvialosa* could be said to have begun, and until more studies have been made of the Australian species, all should be placed in *Nematalosa*.

3. DIAGNOSTIC FEATURES

Before assessing further the relationships of *Nematalosa*, *Konosirus* and *Clupanodon*, eight principal characters must be discussed on which specific and generic divisions have been made.

(i) *Gill Filaments*

In *C. thrissa* alone the outer demibranchs of the first two arches are only half the length of the inner demibranchs; in the remaining species the outer demibranchs are at least three-quarters (usually more) of the inner series. The difference is quite striking and appears to be constant, and it seems to be a strong factor against including *K. punctatus* in *Clupanodon*.

(ii) *Gillrakers*

In *C. thrissa* and *K. punctatus* the longest gillrakers on the lower part of the anterior arch are at least three-quarters the length of the gill filaments opposite. In all other species the gillrakers are approximately half the length of the gill filaments, often less.

(iii) *Parietal Sculpture*

In all species in this group there is a flat, longitudinally striated, wedge-shaped area at the back of the skull formed partly of the parietals, but to which a postero-lateral edge of the frontals also contributes. This area is only lightly covered with skin. The striations conform to two general types, referred to here as the *sardinella* pattern and the *harengula* pattern (in which two genera they are best developed amongst the clupeids). In the former there are 5–10 striae running almost the entire length of the exposed bony area, and posteriorly there is usually a well-defined transverse bony ridge. This type occurs in *N. come* (see Text-fig. 1*a*), *N. japonica*, *N. nasus*, and usually but not invariably in *N. horni*. The *harengula* pattern normally lacks the transverse ridge, or it is less prominent, and the longitudinal striae are much fewer (about 3–5) and often discontinuous. This occurs in *C. thrissa, K. punctatus* and *N. arabica* (see Text-fig. 1*b*).

It is difficult to assess the importance of these patterns, and especially since even in *Harengula* and *Sardinella* there are a few exceptions (thus *H. nymphaea* has 8–10 striae). Certainly *N. arabica* more closely approaches *C. thrissa* and *K. punctatus* in jaw structure than do any of the species with a *harengula* pattern. *N. japonica* on the other hand shows a striation pattern in some respects intermediate between the *harengula* and the *sardinella* types. There is also some variation with age.

(iv) *Scutes*

The total number of ventral scutes does not vary much between the three genera (range 28–36) and there is considerable overlap between species. Nonetheless certain trends are apparent when pre- and post-pelvic scutes are considered separately.

In the pre-pelvic series the Australian species (Whitley's *Fluvialosa*) have a consistently lower count. In the post-pelvic series, as well as in the total count, *K. punctatus*, *N. japonica* and *N. arabica* all have a rather high count in comparison with the Australian species. Rather surprisingly *C. thrissa* falls within the latter group. Apart from this exception, scute numbers tend to confirm the rather distinctive character of the Australian species, although there is no clear division and *C. thrissa* appears to be intermediate between the two groups.

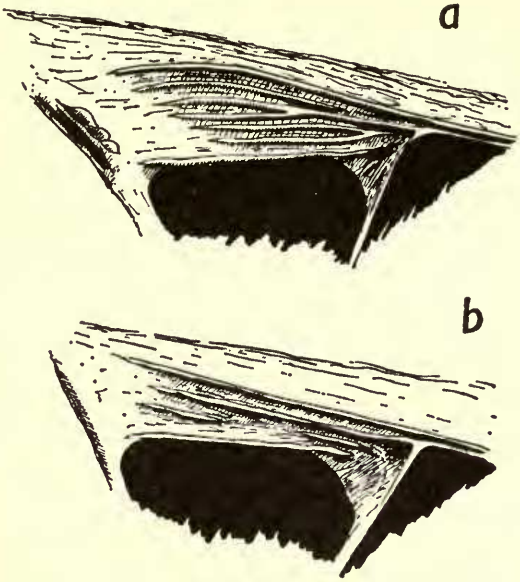

FIG. 1. Two types of parietal sculpture, right lateral view.
(a) *Nematalosa come* (the '*sardinella*' type).
(b) *Nematalosa arabica* (the '*harengula*' type).
For explanation see text.

TABLE I.—*Ventral Scutes in Certain Indo-Pacific Dorosomatidae*

	Pre-pelvic	Post-pelvic	Total	Number of Specimens
Clupanodon thrissa	(17) 18 (19)*	11–12	(28) 29–30 (31)	5
Konosirus punctatus	(17) 18–19 (20)	15–16	(32–33) 34–35 (36)	13†
Nematalosa arabica	(18)19	(13) 14 (15)	(32) 33 (34)	9†
N. japonica	18	14–16	32–34	3†
N. nasus	18	11–13	29–31	5
N. come	18	12–13	30–31	5†
N. erebi	16–17	11–14	28–31	5
N. horni	16–17	12–13	28–30	5†
N. elongata ‡	17	11	28	1

* Parentheses indicate single instance.
† Including the type(s).
‡ Based on Whitley (1943).

(v) *Suboperculum*

Herre & Myers (1931) first noticed that the shape of the exposed portion of the suboperculum in *C. thrissa* and *K. punctatus* differed from that of related species. In these two species it is far less rectangular (see Text-figs. 3*a* and *b*). In fact, this difference in shape is not only a difference in posterior outline of the suboperculum, but results also from the angle made by the lower edge of the operculum with the

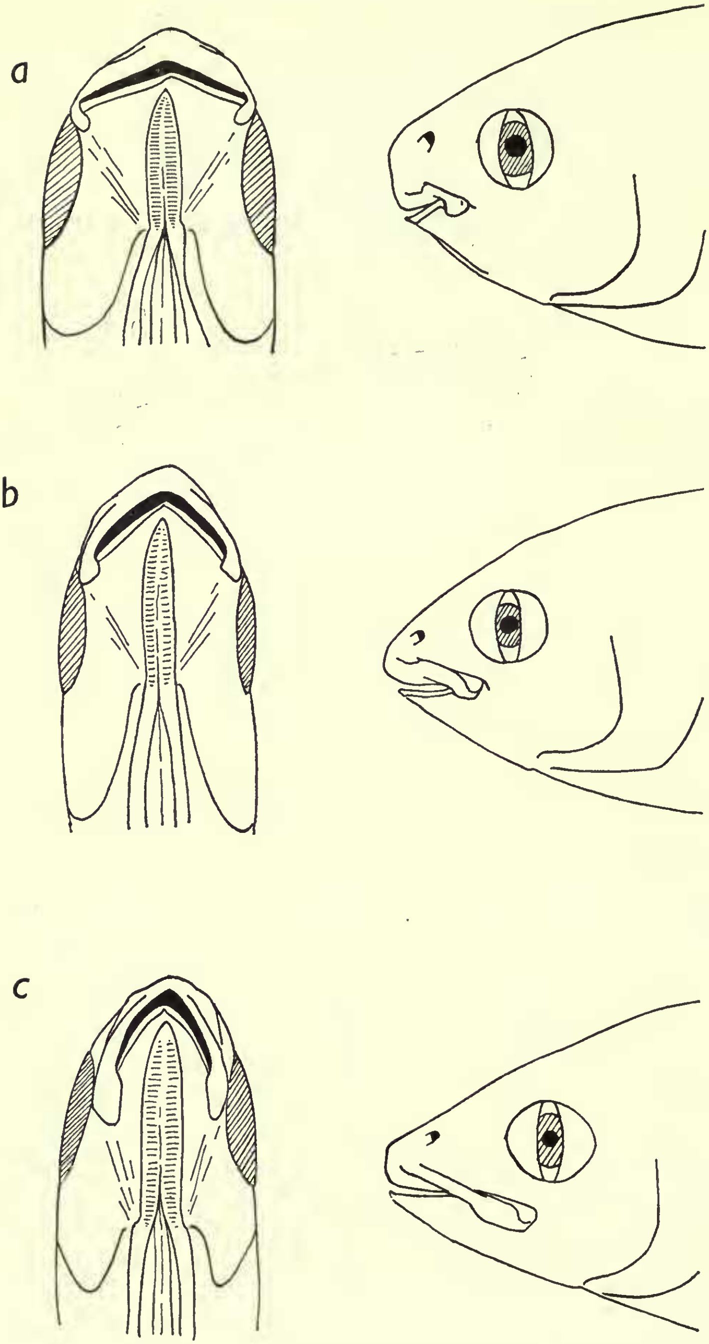

FIG. 2. A comparison between the short and rather wide jaws of (a) *Nematalosa horni* (specimen 140 mm.), the longer and narrower jaws of (c) *Clupanodon thrissa* (172 mm.), and the intermediate condition found in (b) *Nematalosa arabica* (150 mm.). Ventral and lateral views.

posterior margin of the inter-operculum. In *C. thrissa* and *K. punctatus* this angle is obtuse, but in the others it approaches a right-angle. The difference appears to be consistent in fishes of all sizes.

(vi) *Dorsal rays*

In dorsal (and anal) fin ray counts there is some advantage in counting branched and unbranched rays separately. Thus some species may be distinguished by a small but constant difference of only one or two rays, but where the first and second unbranched rays are small or even minute, this difference may be missed.

Regan (1917) separated *N. horni* and *N. erebi* from other species because of their low dorsal count. In the following table this low count is shown to result mainly from a low branched ray count.

TABLE II.—*Branched and Unbranched Dorsal Rays in Certain Species of Dorosomatidae*

	Unbranched	Branched	Total	Number of Specimens
N. arabica	4–5	(12)* 13–14	17–18	8†
N. japonica	4	13 (14)	17 (18)	3†
N. nasus	4–5	12–13	(16) 17 (18)	4
N. come	4	13 (14)	17 (18)	8†
N. erebi	(3) 4	10–11	14–15	12†
N. horni	3–4	9–11 (12)	13–15	10†

* Single instances in parentheses.
† Including the type(s).

Apart from *N. horni* and *N. erebi*, the remaining species are remarkably alike in this character.

(vii) *Upper and Lower Jaws*

Between *Clupanodon thrissa* and *Nematalosa horni* there exists a graduated series of jaw forms in which the species can be arranged in the following order.

Clupanodon thrissa
Konosirus punctatus
Nematalosa arabica
N. come and *N. japonica*
N. nasus
N. horni, *N. erebi* (and if valid, *N. elongata*)

This series consists of a progressive shortening of the upper jaw elements, a deepening of the premaxilla, a more inferior mouth, a widening of the dentary and flaring of its outer edge (especially at the corners of the mouth), and an increasingly wide angle made by the dentaries at their symphysis. Three stages in this series are shown in Text-fig. 2*a*, *b* and *c*.

As Herre & Myers (1931) noted, the expanded portion of the maxilla (i.e. the distal end) is in *Clupanodon* and *Konosirus* rather elongated and extends as far beyond the premaxilla tip as the length of the premaxilla itself ; with the inclusion of the supramaxilla, the expanded portion of the maxilla becomes approximately rectangular, the length of the expanded portion comprising a half to two thirds of the whole length of the maxilla. From the specimens available it appears that the maxilla in *K. punctatus* does not quite attain the length found in *C. thrissa*, but is almost exactly intermediate in this respect between the latter and *N. arabica* (in which the expanded portion is contained $2\frac{1}{2}$–$3\frac{1}{2}$ times in the length of the maxilla). *N. come* and *N. japonica* represent a further reduction in the length of the expanded portion as well as a trend towards a downwardly directed tip to the maxilla. In *N. nasus*, and to a greater extent in the Australian species, this latter trend is further accentuated by a turning

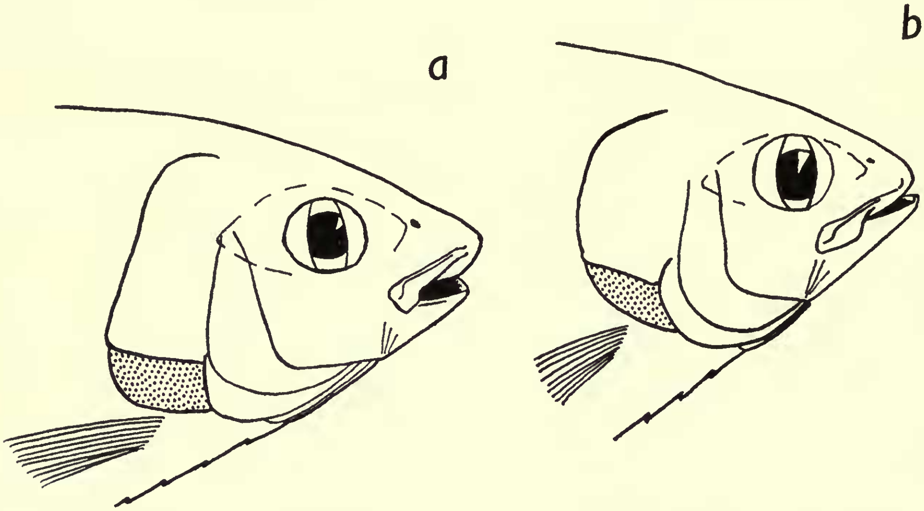

FIG. 3. The shape of the exposed portion of the suboperculum (stippled), determined in part by the angle formed by the lower edge of the operculum and the posterior edge of the interoperculum.

(a) *Nematalosa arabica* (150 mm. specimen).

(b) *Clupanodon thrissa* (180 mm. specimen).

inwards of the maxilla tip round the flared corners of the lower jaw. The series shows a reduction of the narrow stem of the supra-maxilla and the premaxilla becomes shorter and slightly deeper.

The series also shows a shortening of the lower jaw (from dentary symphysis to quadrate articulating facet), and at the same time the mouth, when viewed ventrally, becomes wider and more nearly a straight transverse line (see Text-fig. 2). With the flaring of the dentary, the lower jaw is no longer included in the upper when the mouth is closed.

With these changes comes a slight shortening of the snout, the head in profile becoming deeper and less acutely pointed anteriorly.

Although specimens of *N. horni* or *N. erebi* seem to differ strikingly in mouth shape from say *C. thrissa*, the difference is one of degree only and the remaining species provide almost perfect intermediate steps. Once again there is no basis for separating the Australian species.

(viii) *Second Sub-orbital*

Normally the second sub-orbital extends to about the centre of the orbit and its anterior border forms a diagonal (Text-fig. 4*a*). In *N. nasus*, however, this bone covers the entire cheek, terminating in front of the eye, and its anterior border is vertical (Text-fig. 4b). This single exception is not related to any of the other trends found.

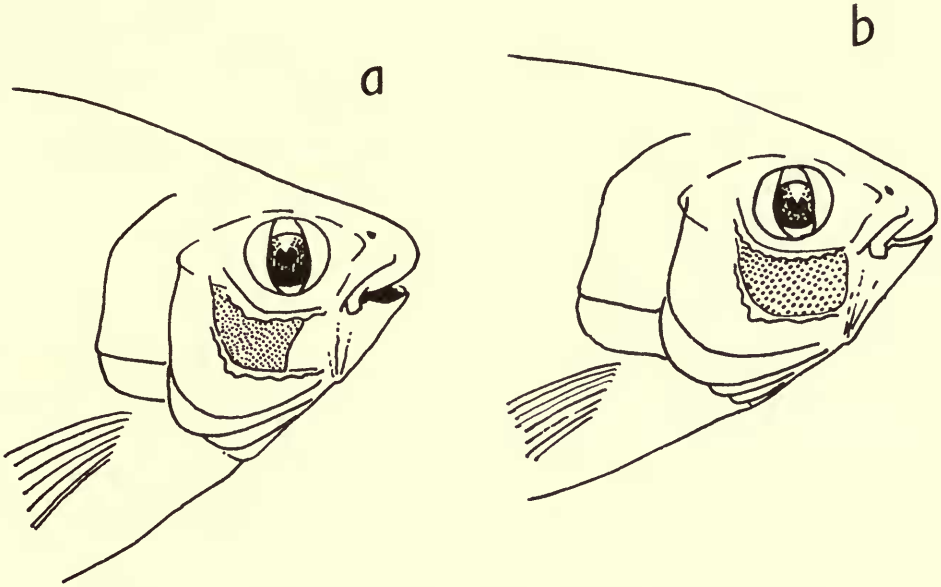

FIG. 4. The shape and extent of the second suborbital (stippled).

(a) *Nematalosa come* (129 mm.).

(b) *Nematalosa nasus* (115 mm.).

4. DISCUSSION

Of the characters discussed, jaw form shows the most complete transition, with a perfectly graded series between the "normal" jaw of *Clupanodon thrissa* and the pronounced inferior jaws of *Nematalosa erebi* and *N. horni*. This series may reflect a progressive trend towards bottom-feeding, for the mouth shape of the Australian species strongly resembles that of the iliophagous grey mullets ; unfortunately there are insufficient records of food and feeding habits to confirm this.

To what extent do other characters conform to this series ? Comparing the tables given for dorsal rays, vertebrae and pre- and post-pelvic scutes, exactly the same order of species can be maintained with one exception ; *C. thrissa* has unexpectedly low vertebral and post-pelvic scute counts if it is to head the series. However, this does not seem to be a strong objection to the order of the species and may well represent a variation similar to the unique sub-orbital shape in *N. nasus*.

As a whole, species in this group show a great number of similarities and common features, and there is something to be said for placing all in a single genus, perhaps giving *C. thrissa* subgeneric status. But there are several rather distinctive features found in one, two, or at the most three species only, which appear to be unrelated to the general trend found in mouth shape or meristic characters. Thus the differences in gillraker and gill filament length, and the shape of the suborbital and subopercular bones serve to fragment the group.

Two main evolutionary trends are apparent. The first, which can be broadly linked with geographical distribution, involves mouth shape and certain meristic characters, and shows a gradual transition from one species to the next. The second, apparently unrelated to distribution, shows no intermediates and appears to represent merely variations in individual species or species pairs. Thus within the group, there is a reasonably complete series between *N. horni* and *N. arabica*, but there is a distinct break between these and *C. thrissa* and *K. punctatus*, which themselves can be clearly separated.

In the first group of characters (those which intergrade) it is difficult to decide whether the non-meristic series (i.e. jaw form) should be accorded the same status as the meristic series. Thus, there is good reason to suspect that scute, finray and vertebral numbers can be correlated with distribution (i.e. with an extrinsic factor such as temperature), whereas with jaw shape, these may be merely representative stages in the evolution of the group. That the species can be arranged in the same order in respect to both these kinds of character may be coincidental.

In the second, or non-intergrading, group of characters, the differences between the species are often rather greater than one would expect, and it is perhaps surprising to find the aberrant form so often represented by only one or two species. Taken in conjunction with the intergrading series, the impression gained is of a group in which a few well adapted forms have survived, showing little tendency to speciate except amongst the Australian fishes, which are the most specialized and perhaps the most recent. *K. punctatus* (with a slightly higher vertebral count) and *C. thrissa* are probably the primitive members of the group.

5. A REDESCRIPTION OF *NEMATALOSA ARABICA* REGAN 1917

This description is based on the holotype (131 mm. S.L., B.M. (N.H.) No. 1887.11.11.312); a specimen from Mukalla labelled *N. nasus* (150 mm. S.L., B.M. (N.H.) No. 1945.12.31.14); and six specimens from Jibuti, Somaliland (94–101 mm. S.L., B.M. (N.H.) No. 1962.3.13.1–6).

Description

In percentages of standard length (S.L.): head length* 29·3–31·7, head depth at occiput 23·4–26·0, body depth 36·0–40·5, snout length 6·1–7·6, eye diameter 7·3–7·8, post-orbital† 13·9–15·3, premaxillary length 4·5–5·7, maxillary length 6·5–8·2, pectoral length 20·5–23·0, pelvic length 12·4–14·0, length of anal base

* Premaxillary symphysis to posterior edge of suboperculum, i.e. not a horizontal line. This obviates measuring to inclined operculum edge.

† These last three measurements are taken in a straight line through the eye and therefore do not *in toto* equal head length.

15·3–17·9, pre-dorsal distance 49·0–51·0, pre-pelvic distance 52·0–54·5, length of last (filamentous) dorsal ray 35·5–41·0, depth of caudal peduncle (11·0) 12·1–12·9.

Premaxilla 1·14–1·77 times in length of maxilla ; the length of the expanded portion of the maxilla 2·40–3·40 times in the length of the whole bone, the depth of the expanded portion 2·57–3·13 times in maxilla length. Maxilla tip reaching to below anterior pupil border.

Gill rakers about half length of gill filaments on anterior arch ; outer demibranch equal or subequal to inner demibranchs.

42–45 scales in lateral series, 19 in transverse series. Ventral scutes 18–19 + 13–15 (total 32–34). Dorsal iv–v, 12–14 (total 17–18) ; anal ii–iii, 15–17 (total 18–20). Vertebrae 46 (1 specimen).

Pelvic fin base lies below 2nd or 3rd branched dorsal ray. Pectoral tips reach or almost reach pelvic fin base.

Angle between posterior margin of inter-operculum and ventral margin of operculum forming a right-angle, the sub-operculum appearing roughly rectangular (Text-fig. 3*a*). Parietal striae 3–5 (Text-fig. 1*b*). Mouth inferior, the dentary moderately expanded and reflected outwards (but not as strongly as in *N. come*) as shown in Text-fig. 2*b*.

6. GENERIC DIAGNOSES

In view of the foregoing comments on the three Indo-Pacific dorosomatid genera with filamentous last dorsal rays, more precise generic definitions can be given.

Nematalosa Regan

Nematalosa Regan, 1917, *Ann. Mag. nat. Hist.* (8) **19** : 313. (Type *Clupea nasus* Bloch, designated by Jordan, 1920, Genera of Fishes, Pt. 4, p. 560).
Fluvialosa Whitley, 1943, *Aust. Zool.* **10** (2) : 170.

Indo-Pacific dorosomatid fishes with the last dorsal ray produced into a filament. Mouth subterminal or inferior ; premaxilla short but deep ; maxilla slender, expanded distally and curved both downwards and slightly inwards round the dentary ; a single supramaxilla ; dentaries meeting at their symphysis at an obtuse angle, forming sometimes an almost transverse cleft, the edge of each dentary flared or reflected outwards. Second suborbital with diagonal front border leaving an exposed area above the lower limb of the preoperculum (Text-fig. 4*a*) except in *N. nasus*, in which the front border is vertical (Text-fig. 4*b*). Suboperculum rectangular, the anterior and upper borders of the exposed portion forming an approximate right angle and the posterior margin angular and not smoothly rounded (Text-fig. 3*a*). Gillrakers on first arch half or less than half the length of the corresponding gill filaments ; outer demibranchs on all arches at least threequarters of the length of the inner demibranchs.

Dorsal rays iii–iv, 9–14, anal rays 18–24 (of which the first two or three are unbranched), pelvic rays 8. Scales, 42–50 in lateral series, 14–21 transversely. Ventral scutes, 16–19 pre-pelvic, 11–16 post-pelvic, total 28–34.

Six species of *Nematalosa* are recognized here, *N. arabica*, *N. japonica*, *N. come*, *N. nasus*, *N. erebi* and *N. horni*.

Clupanodon Lacépède

Clupanodon Lacépède, 1803, *Hist. Nat. Poiss.*, **5** : 465. (Type *Clupea thrissa* Linnaeus, designated by Bleeker, 1866–72, *Atlas Ichth. Ind. Neerland*, **6** : 112).
Thrissa Rafinesque, 1815, *Analyse de la nature*, p. 88.

Indo-Pacific dorosomatid fishes with the last dorsal ray prolonged into a filament. Mouth subterminal ; premaxilla short but less deep than in *Nematalosa*, maxilla slender, expanded terminally but not curved downwards or inwards ; a single supramaxilla ; edge of dentaries not reflected outwards, dentaries meeting at their symphysis at an acute angle (Text-fig. 2*c*). Second suborbital with diagonal front border, leaving exposed area above lower limb of preoperculum. Suboperculum not rectangular, anterior and upper borders of the exposed portion of the bone forming an angle greater than 90° (Text-fig. 3*b*). Gillrakers on first arch at least threequarters of the length of the corresponding gill filaments ; outer demibranchs on the first two arches only half the length of the inner demibranchs.

Dorsal rays iii–iv, 13–14, anal rays ii–iii, 19–23, pelvic 8. Scales, 44–45 in lateral series, 17 transversely. Ventral scutes, 17–19 (normally 18) pre-pelvic, 11–12 post-pelvic, total 28–31 (normally 29–30).

A single species recognized, *C. thrissa*.

Konosirus Jordan & Snyder

Konosirus Jordan & Snyder, 1900, *Proc. U. S. nat. Mus.*, **23** : 349. (Type *Chatoessus punctatus* Schlegel.)
Nealosa Herre & Myers, 1931, *Ling. Sci. J.*, No. 10 : 236. (Type *Chatoessus punctatus* Schlegel.) See also Myers, 1931, *Copeia*, No. 1, p. 30.

Indo-Pacific dorosomatid fishes with the last dorsal ray prolonged into a filament. Mouth subterminal ; premaxilla short and in depth intermediate between *Nematalosa* and *Clupanodon* ; maxilla slender, expanded distally and similar to that of *Clupanodon* ; a single supramaxilla ; dentaries with slightly reflected outer edges and meeting at their symphysis at a fairly acute angle (again intermediate between the condition found in *Clupanodon* and *Nematalosa*). Second suborbital with diagonal front border leaving exposed portion above lower limb of preoperculum. Suboperculum not rectangular, anterior and upper borders of the exposed portion of the bone forming an angle greater than 90° (as in *Clupanodon*). Gillrakers on first arch at least threequarters of the length of the corresponding gill filaments ; outer demibranchs of the first two arches at least three quarters of the length of the inner demibranchs (as in *Nematalosa*).

Dorsal rays iii–iv, 15, anal ii–iii, 17, pelvic 8. Ventral scutes 17–20 (normally 18–19) pre-pelvic, 15–16 post-pelvic, total 32–36 (normally 34–35). Scales, 42–46 in lateral series, 17 transversely.

A single species recognized, *K. punctatus*.

7. A Key to the Dorosomatidae of the Indo-Pacific*

* Excluding four doubtful Australian species (*N. richardsoni*, *N. elongata*, *N. paracome* and *N. bulleri*) for which there is insufficient published data—see p. 91.

I. Last dorsal ray not prolonged into a filament.

A. Maxilla slender, distal end slightly expanded and curved downwards . ***Gonialosa***

i. Depth 2·0–2·5 in length ; 45–47 lateral scales . . . . . ***G. modesta***

ii. Depth 2·6–3·2 in length ; 55–65 lateral scales . . . . . ***G. manminna***

B. Maxilla straight, thin, tapering terminally . . . . . ***Anodontostoma***

i. Dorsal 15 ; 19 transverse scales ; snout little protruded . . ***A. chanpole***

ii. Dorsal 17–18 ; 12–13 transverse scales ; snout well protruded . ***A. chacunda***

II. Last dorsal ray prolonged into a filament.

A. Gillrakers of the first arch at least threequarters of length of corresponding gill filaments ; suboperculum not rectangular, its anterior and upper margins forming an obtuse angle, its posterior margin rounded ; outer edge of dentary not or but very slightly flared.

i. Outer demibranchs on first two gill arches at least threequarters of length of inner demibranchs ; vertebrae 48–51 ; post-pelvic scutes 15–16 ***Konosirus punctatus***

ii. Outer demibranchs on first two gill arches only half length of inner demibranchs ; vertebrae 43 ; post-pelvic scutes 11–12 . . . . ***Clupanodon thrissa***

B. Gillrakers of first arch half or less than half length of corresponding gill filaments ; suboperculum rectangular, its anterior and upper margins forming an approximate right angle ; dentary more or less flared . . . . . . ***Nematalosa***

i. 2nd suborbital covering whole cheek, anterior edge vertical, lower edge horizontal and in contact with preoperculum . . . . . . ***N. nasus***

ii. 2nd suborbital with oblique anterior edge, leaving exposed area above lower limb of preoperculum

a. Post-pelvic scutes 13–16, total ventral scutes 32–34 ; dentary moderately flared ; depth $2\frac{1}{2}$–3 in length.

α Depth $2\frac{1}{2}$–$2\frac{3}{4}$; anal 18–20 . . . . ***N. arabica***

β Depth 3 times in length ; anal 21–23 . . . . . ***N. japonicus***

b. Post-pelvic scutes 11–14, total scutes 28–31 ; dentary strongly flared at edges, mouth becoming inferior ; depth 2–$2\frac{4}{5}$ times in length, Australian species.

α 13–14 branched dorsal rays . . . . ***N. come***

β 9–12 branched dorsal rays

† Depth 2–$2\frac{1}{2}$ in length ; pelvics below or immediately in advance of dorsal origin . . . . ***N. erebi***

‡ Depth $2\frac{1}{3}$–$2\frac{4}{5}$ in length ; pelvics below anterior half of dorsal . ***N. horni***

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